LUBRICATION

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We invite correspondence from all those interested.

Those who fail to receive LUBRICATION promptly, will please notify us at once and will confer a favor by promptly reporting change of address.

THE RIGHT LUBRICANTS AFTER FIFTEEN YEARS

In the Lackawanna District of the Anthracite Regions, one of the large operators had for fifteen years used exclusively oil supplied by one Company for his colliery, breaker, and other equipment.

In April, 1914, one barrel of TEXACO CRATER COMPOUND was ordered on approval, with the understanding that our engineer was to make the initial applications to two wire ropes, each 1½" in diameter and 600 feet in length, pump plungers, ash conveyor gears, other gears about the breaker and colliery, and to any other conditions about the plant for which it is adapted.

Two weeks later applications were made to pumps, gears, and all other conditions. The superintendent reported that "CRATER" was everywhere satisfactory, and on the ropes and several other conditions had given a wonderful performance. As a result of the good work of CRATER COMPOUND our other oils were then seriously considered.

This operator uses considerable quantities of other lubricants such as steam cylinder oil, engine and machine oil, black lubricating oil for mine cars, and cup grease, and arrangements were finally made for our engineer to inspect all of the lubricating conditions.

After our inspection report we were notified to have the necessary oils on hand for our test.

The crank-cases and lubricators of the compressors were cleaned, hoods placed over crank-case discs, and crank-cases and lubricators filled with TEXACO Canopus Oil and TEXACO Draco Cylinder Oil. Canopus Oil was placed in the vacuum lubricators feeding the air cylinders. After TEXACO Lubricants had been in use 39 days, the following results were reported to the management: 50% reduction in the consumption of Cylinder Oil in Power House; 40% reduction in the consumption of Air Cylinder Oil.

All lubricating conditions very satisfactory.

December, 1915, the equipment was inspected; the air and steam valves were removed, also the heads from the air and steam cylinders, all of which were perfectly lubricated, with no trace of carbon on valve springs or valves as had been the case previously.

Both superintendent and manager are highly pleased with the results, and TEXACO Lubricants are now being used exclusively.

This illustrates two things. First, that "CRATER" is a most successful opener of accounts, owing to its great value for any work upon which it is put. Second, the rest of our oils are in exactly the same class—their use always produces satisfaction.

DIESEL ENGINE LUBRICATION

Based on a Report by J. L. WILSON, Engineer, The Texas Company, Philadelphia District

A manufacturer of a horizontal Diesel Engine has a 45 H. P. engine which furnishes light for the factory. This engine is a four-cycle horizontal type, 13½x16, and cylinder is water jacketed. As this particular engine has been in the shop for some time, it has been used for testing out various oils. Generally, the record has shown that the best of all of the oils tested on this engine gave a considerable amount of carbon which had to be scraped every three to twelve weeks. At the same time, due to excessive wear on the wrist pin brasses, the boxes had to be scraped and the connecting rod brasses keyed up. At times during some of the former tests it was necessary to remove the piston every week to scrape the carbon formation from the piston, valves, and cylinder head. The best record with any oil previous to the use of Texaco Ursa Oil was twelve weeks, and this was considered a remarkable record by the engine people.

The construction of this engine is such that a slight amount of carbon on the piston results in loud knocking which is due to excessive compression caused by the reduction in clearance space taken up by the carbon; also that carbon has a tendency to form a hard deposit, heats up and becomes incandescent, causing pre-ignition. The longest record on any competitive oil on this particular engine was a run of twelve weeks. At the termination of twelve weeks' time (the former record) of lubrication with Texaco Ursa Oil, the engine was opened up for inspection, though previous to this inspection everything operated satisfactorily, no knocking having occurred.

The examination disclosed some carbon; that from the piston heads being very carefully removed so it could be compared with the carbon that was removed after the use of the best previous oil. Samples of the oil were also secured so that they could be compared with the samples of the best previous oil. In both cases the samples were removed after 115 hours' run, the unit having operated under identical conditions. The analyses of all samples are as follows:

Laboratory Test of Fuel Oil

	Used During Test of Competitive Oil	Texaco Ursa Oil
Gravity	33.2	23.4
Flash, P. M.	205° F.	178° F.
Viscosity, Saybolt Universal at 100°F	41″	40″
Sulphur	0.48%	0.48%
Deposit	0.1 %	Trace
Distillation		
Boiling at	396° F.	400° F.
10%	472	478
20%	506	508
30%	530	532
40%	546	552
50%	576	572
60%	594	594
70%	620	620
80%	654	646
90%	696	687
95%	730	730
96% (End)	...	746

	Best Competitive Diesel Engine Oil	TEXACO URSA OIL
Gravity, Beaume	23.6	20.5
Flash	405° F	385° F.
Fire	470° F.	445° F.
Pour Test (Cold Point)	55° F.	0°F.
Viscosity, Saybolt Universal at 210°F	89″	59″
Color	Dark Green	

Carbon Deposit

Total Weight	19.413 grms.	10.086 grms.
Oil	11.14%	8.22%
Soluble in CS_2	0.82%	1.22%
Ash	2.88%*	2.97%*
Insoluble Carbonaceous	85.16%	87.59%

(*Iron and Silica)

The engine was then restarted on Texaco Ursa Oil and after six months' continuous use the plant people report that they have had absolutely no trouble of any kind in regard to the lubrication of this engine since Ursa Oil was first put on, October 15, 1915. The trouble they formerly experienced, which was due to carbon and to the excessive wear on the wrist pin brasses and which necessitated the scraping of the boxes and the keying up of same every three to four weeks, has been entirely overcome. There is absolutely no indication of carbon as far as the workings of the engine are concerned.

The engine people are so greatly enthused over the fine action of their engine on Texaco Ursa Oil that they are recommending it to all of their customers.

The above case is only one of the very many that we have received regarding the operation of internal combustion engines of all types, makes and sizes, lubricated with Texaco Ursa Oil. Generally, the stories are all about the same; that previously many of the best competitive oils were in use; that the trouble encountered in keeping the engines running varied with all of the oils, but was not entirely overcome with any of them until Ursa Oil was placed in the systems.

All of these particular tests are directly in line with what Ursa Oil will do in internal combustion engine work. This oil is an exceedingly fine, heavy lubricant of very low carbon content. With its high viscosity, it is the lowest flash oil on the market, a feature which is quite necessary for a good internal combustion engine oil. Further, its boiling point is unusually high; this is due entirely to the nature of the crude from which we make this oil, and these peculiar features can not possibly be duplicated. It is a great satisfaction for us to have as efficient an oil as Texaco Ursa Oil for the fine work that we like to do for our discriminating customers.

WIRE ROPE LUBRICATION

By GEORGE R. ROWLAND
Supervising Engineer, The Texas Company

Wire rope is an appliance well adapted to a multitude of uses. Adaptability in an engineering sense means economy and safety. The trend of evolution has practically eliminated the use of hemp rope in many kinds of operations. Wire rope excels in economy and efficiency because of its length of life under heavy duty on account of its superiority in strength per unit of size.

To develop some accurate information as to the frictional surfaces requiring lubrication in a wire rope, inquiry was made of one of the largest rope manufacturers in this country, and the figures given will show the actual frictional surfaces to be lubricated in 100 feet of 1″ wire rope—a grand total of 334 sq. ft. of surface to be lubricated.

1" Steel Rope is Standard for 100 ft.—1200 inches.			
1 Wire in center—.050" C—.050x 3.1416x1200—.15708x1200 =		188.50	
6 Wires in 1st layer—.050" dia..		1130.98	
6 Wires in 2nd layer .050" dia..		1130.98	
6 Wires in 2nd layer .040" dia..		904.98	
18 Wires in 3rd layer .045" dia..		3053.64	
37 Wires	1 strand..	6408.90	
	6 strands..	38453.4	sq. in.
	or	267	sq. ft.
For curvature add about 25%		67	sq. ft.
		334	sq. ft.

As a matter of comparison, measurements were made by our technical forces in connection with the technical forces of a large steel mill on a 35,000 H. P. Twin Tandem Reversing Engine, which showed that there were 319 square feet of actual frictional surfaces to be lubricated. These figures are given to more strongly emphasize the fact that every foot of wire rope is a moving part subject to friction which, to secure the proper efficiency and service, must be given the same attention in the way of lubrication as any other mechanical device.

Wire rope deteriorates with use but not with age when properly cared for, and the rate of deterioration depends to a great extent upon the character of the metal used, the construction of the rope, diameter of drums, sheaves and pulleys over which it operates, and to a very great degree upon how it is lubricated. A rope may be made with very great accuracy and meet every specification that human ingenuity can devise, but if not properly lubricated or protected from the elements that may attack its constituent parts, the value of the rope and the desired economy cannot be secured; consequently, the protection and lubrication of wire ropes are of vast importance. This applies to ropes lying idle as well as to ropes in service, as rust destroys as effectually as hard work.

The question of efficiency in lubrication has recently assumed a position of considerable importance in the minds of wire rope manufacturers and purchasers. This in the case of the manufacturers is largely due to their being required by the purchasers, in many instances, to give a guarantee in regard to the life and performance of the ropes. The rope manufacturer may use the best technical knowledge at his disposal and be extremely careful in selecting the material which goes into his rope, but he cannot be expected to estimate beforehand the rapid and varying degrees of deterioration of the rope when it is in the hands of the rope user, who, it often happens, does not fully appreciate that the conservation of the life of the rope is entirely under his direction. Even the most perfect rope can be used under such severe conditions and lack of attention that it will have a very short life, while a rope of much inferior quality, used under the same conditions of service but given careful attention in the way of lubrication, will outlive the higher grade rope. This is common knowledge among all rope users and manufacturers. The whole matter rests upon the efficiency and suitability of the lubricant used.

A careful investigation of the ropes used in all classes of service has shown that no two manufacturers are using the same grade of rope lubricant, and an analysis of the materials most commonly used and recommended for this class of work shows that tar, graphite, and other fillers are used in very large proportions—this, no doubt, for the purpose of developing a very heavy, adhesive mixture. These mixtures are commonly sold under the names, "rope shield," "rope dressing" and "protector."

Such materials have the effect of only partially protecting the external parts of the rope, and at low temperatures will crack and peel. This may be noticeable only in spots, but it has the effect of permitting the deteriorating elements to attack the internal parts of the rope, and instances are not infrequent of ropes suddenly breaking while the visible wires show no signs of deterioration, it being invariably found upon examination that the internal wires have perished by corrosion.

In some instances ordinary Black Oil or what is commonly known as "Waste Oil" is used. Both of these materials are worthless as a rope lubricant, as neither will cling to the outer surfaces, penetrate to the core, nor resist the effects of moisture and other contaminating elements. Where such materials are used frequent applications are necessary, and owing to their characteristics they afford no lubrication to sheaves, drums and pulleys and are either thrown off or evaporate within a few hours after they are applied, thus leaving the rope at the mercy of the elements and of frictional wear. Many high grade and expensive greases have been used which perhaps by laboratory analysis are shown to possess the qualifications necessary for resisting the effects of moisture and chemicals, but which on account of the high speed at which ropes are often operated and the consequent stress and vibration to which they are subjected are readily thrown off and at no period after application afford more than a temporary protection to the external surfaces of the rope.

In some instances the wire rope purchasers specify that their ropes must be given a heavy external coating or slushing by the manufacturer. This has the effect of necessitating an extra operation in the process of manufacture and often causes considerable annoyance in the way of the material dripping from the ropes in the manufacturer's warehouse and in transit of the rope to destination; and after the rope is put into service this heavy external coating is carried to the sheave wheels and drum, and such of the material as has not dripped away is thrown off, causing further annoyance to the operating men.

The following specifications cover fully all that is practical in the matter of lubrication connected with the manufacture of ropes:

> "These lines to be treated with Texaco Crater Compound in the process of manufacture, both internally and externally, and the manila core to be thoroughly saturated with Crater Compound before being placed in the center of the rope, and the six strands comprising the rope; so that every wire is thoroughly covered and the interstices between the different wires are completely filled with Crater Compound, so that when perfectly coated with this coating the compound will not run to the bottom of the reel in warm climate nor be objectionably sticky in handling."

This specification has been adopted by the Purchasing Agent of the Producers Oil Company, who purchases approximately half a million feet of wire rope per year, and requires the use of one material for core saturation and for lubrication of the wires of each strand; and records of ropes that have been carefully watched show an increase in the life or service of these ropes of from 25% to 50%.

It rarely occurs now-a-days that the full efficiency of a rope is developed, owing to various service conditions, such as its coming into contact with acid fumes and, particularly, coming into contact

with water containing deteriorating elements, which have the effect of producing corrosion and consequent brittleness of the wires; the higher the carbon content of the metal the more susceptible are the wires to this corrosion.

A series of practical tests, conducted by high class technical men under the supervision of the writer, has demonstrated that the use of a poor, or unsuitable lubricant will often do more to lessen the durability of a rope than using no lubricant at all, and that the cost of a lubricant which will meet all of the operating conditions is trifling as compared with the saving it makes possible.

A report recently received from one of the largest coal producing companies in this country shows that a 1⅞" wire rope which was treated with Texaco Crater Compound in the course of manufacture, put into service in January 1915, operated until January 1916, having hoisted 101,815 tankfuls of water. Two ropes previously used on the same operation, not treated with Crater Compound, were in service about six months each and hoisted 51,742 and 65,225 tankfuls of water, respectively. This was an underwind rope, used in connection with a water hoist where the water contains an average of 6 to 15 grains of sulphuric acid per gallon. These figures give absolute proof of the value of the use of a proper lubricant, as on this same operation the ropes had been left to the mercy of the elements and to the initial application of the lubricant owing to the fact that up to the time Texaco Crater Compound was tested out with the results above indicated no lubricant had been found that would meet the existing conditions.

An efficient wire rope lubricant must be free from any material that will attack the constituent parts of the rope, must remain soft and pliable under all atmospheric conditions, and must not be subject to evaporation; it must be insoluble in water so as to prevent the water from coming into direct contact with the surfaces of the rope, and must be unaffected by water heavily charged with chemicals such as exist in some operating conditions. It must be of such a nature that it will penetrate between the wires in the strand and between strands to the core of the rope when the rope has been put into service, preserving the core as well as the metal which surrounds it. It must not be subject to decomposition under the severest conditions of wear, and must possess great adhesiveness so that it will not be thrown off by any force; it must be a material that will not harden nor peel, either through too frequent application, as is often the case, or under low temperature conditions; it must be of such a nature that it may be liquefied to a consistency to permit of applications being made very thin.

In addition to meeting the above requirements, the lubricant used for wire ropes should possess characteristics which permit of its showing equal efficiency as a lubricant for sheave wheels, drums, pulleys, and other bearings over which the ropes pass; and to secure the greatest efficiency, this same material should be used to lubricate each wire in the strands and to saturate the core during the process of manufacture, as it often occurs that with the use of one material in the manufacture and another material after the rope has been put into service, the two being of decidedly different natures, no lubricating protection can be ef-

fected on account of one material preventing the other from adhering or penetrating to the interior of the rope. Consequently, the use of one lubricant is of vital importance. Further, if the core is properly saturated during the process of manufacture, as soon as the stress of load is applied to the rope, a sufficient amount of the lubricant will be forced out between the strands to properly lubricate the sheave and drum over which the rope passes, until such time as it is necessary to make a further application.

Too little attention has been given to the initial lubrication of wire ropes, particularly as regards proper saturation of the hemp center. It has been the general practice to pass the hemp center through the lubricant used at the time the rope is laid up. When applied in this manner the greater part of the lubricant is forced out between the strands and, in the case of some grades of lubricant, drips entirely away from the external surfaces. The object of inserting the hemp center is to increase the flexibility of the rope, and the deterioration of this center has the same effect as the deterioration of the material surrounding it. If the hemp center is thoroughly lubricated before being inserted into the rope it will act as a container of the lubricant and will assist in distributing it to all parts of the rope; also, if the proper lubricant is periodically applied to the rope it will penetrate and maintain the hemp center as a continuous lubricator.

Another important feature in connection with wire rope lubrication, which has not as a rule received proper consideration, is the method of application. In some instances the lubricant is poured on the rope, either at the sheave wheel or the drum; in other instances it is applied with a brush. Both of these methods are crude and wasteful. The proper way to apply the lubricant is to use a split box of sufficient dimensions to permit of its holding about twenty-five pounds of the lubricant to be used, constructed with a hole in the center large enough to permit of the passage of the largest rope to be coated—when coating smaller ropes, use an old rubber pump valve or a piece of ordinary burlap wrapped around the rope to act as a wiper and to regulate the thickness of the application. These split boxes can be constructed so as to be used on either vertical or horizontal ropes. The lubricant should be thoroughly liquefied in a metal container, and after it is poured into the split box the rope should be permitted to pass slowly through the box. In this manner an economical and uniform application can be made. Wherever possible, the external surfaces of the rope should be dry when the lubricant is applied.

The series of practical demonstrations carried out with the cooperation of the manufacturers and users of wire ropes covered the most severe conditions to be found in all classes of operations, and resulted in proving our claim for having produced a wire rope lubricant which will meet all of the requirements set forth in this article as being necessary for economical and efficient lubrication of wire ropes.

LUBRICATING THE LOW PRESSURE CYLINDERS THROUGH THE HIGH

A matter which has been much discussed by engineers at their formal and informal gatherings, is the possibility as well as the advisability of lubricating the low pressure cylinder by carrying over the lubricating oil from the high pressure cylinder.

Under most conditions and with most cylinder oil, it has been considered practically impossible to secure the proper lubrication of the compound engine unless the oil was fed to both cylinders. In order that an oil should be able to properly lubricate the low pressure while being fed to the high, it must be so thoroughly atomized and mixed with the steam before it gets to the high pressure that the greatest part of it will carry over through the receiver into the low pressure cylinder, so that the valves and walls of the low pressure cylinder will be sufficiently lubricated.

One engineer has solved this problem with Texaco Zenith Valve Oil, securing fine lubrication of both cylinders. At the same time he shows a reduction of 50% consumption of oil against what was used previously.

As will be noted from the superintendent's letter, which is printed below, the consumption has never equalled more than 50% of the maximum required with the former oil fed to the high pressure cylinder.

Inasmuch as so few of the cylinder oils on the market are capable of doing this work even with a very much larger consumption and under normal conditions, the fact that this unit has been run for nearly two years with this reduced feed, while the engine has operated under a heavy overload and with no lubricating being fed to the low pressure cylinder, speaks very definitely of the remarkable qualities of Texaco Zenith Valve Oil.

Final economy is what is always desired in all kinds of lubrication, especially with cylinder oils—it is not the first cost per gallon, but what will the oil do and how long will a gallon last. As a general rule the cheaper cylinder oils will not last so long as the very best grades and can never be expected to do so good and efficient work. In steam cylinder work the question always has been and still is, "How far will a drop go?" The answer is here in this case of the Lane and Bodley engine—a good oil can be used to far greater advantage than an ordinary oil and with a less amount over a greater surface.

The letter follows:

Macon, Ga., March 29th, 1916.

The Texas Company,
Atlanta, Ga.

Gentlemen:

We operate a Lane and Bodley Corliss 18x36x48 inches developing about 700 H.P or about 40% overload. Steam pressure 140 to 150 pounds, saturated; 78 revolutions per minute.

During the use of Zenith Valve Oil we have never fed to exceed ½ maximum per day of 10 hours and have not fed any direct to the low pressure cylinder, but the latter has been abundantly lubricated by the oil passing from the high pressure cylinder.

The performance of this engine is as nearly perfect as possible, carrying such an overload, and speaks well for this high class oil.

Yours truly,
(Signed) The Superintendent.
(*Name on Request*)